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Inoculations into stem nodes of healthy plants, with a pure culture of *Bact. phaseoli* Erw. Sm. have produced typical signs of the disease. Plants so inoculated also showed the characteristic breaking at the stem node.

Plants inoculated in a similar manner with cultures of species of *Fusarium* and *Rhizoctonia* isolated from platings of this diseased stem tissue, showed no girdling or breaking.

It seems likely that infection results from the washing of bacteria from affected cotyledons or leaves to the axils of the leaves, but the method of entry of this organism is not yet worked out.

A more complete report upon this disease will be given at a later date.

J. H. MUNCIE

MICHIGAN AGRICULTURAL EXPERIMENT STATION

QUOTATIONS

SCIENCE AND INDUSTRY

THE important and impressive review of the rise and progress of the organic chemical industry issued by Messrs. Levinstein, Ltd., of Blackley, near Manchester, and of Ellesmere Port, which appeared as a supplement to the *Manchester Guardian* of June 30, marks a welcome development of industrial enterprise. Even the most indifferent and ill-informed reader can not but be made aware, as a result of its perusal, of the importance of the highest facilities for scientific education and training, when in so striking a fashion he is compelled to realize the fruits of it in the enormous industrial advance of Germany in all that pertains to the organic chemical industries, whether it takes the form of artificial dye-stuffs, synthetic organic products, or that of chemico-therapeutics. The advent of the war quickly laid bare our serious deficiencies, not to say our utter poverty, in all three departments of chemical manufacture.

In the course of the articles, which have been written by men eminent in their respective fields of chemical science and its applications, the distinction is made absolutely clear as between industries the development of which has mainly been the result of the

adoption of steam power and of mechanical appliances, and those depending upon fundamental researches of a physical and chemical character, such as are, to use the phrase of one of the writers, "built up from the depths," and require, therefore, not merely the energetic business organizer and "scientific management," with a view to output, but the highly trained scientific man capable of appreciating the discoveries of pure science and apt in their application to human needs. In this valuable review of the progress of the many departments of a vital industry—the key, indeed, to the successful prosecution of many allied and dependent industries—it is clearly revealed how remiss the nation has been in a true appreciation of what constitutes the firm foundation of industrial pre-eminence. The fault has lain not so much, as some of the writers seem to indicate, with the colleges and universities as with the industries concerned, which have hitherto offered small salaries and poor prospects to the carefully trained and competent science student; indeed, have looked upon the chemist as a necessary evil, to be avoided if possible.

One of the most important articles is that by Dr. Levinstein, inasmuch as he carefully points out the respective spheres of the university and the works in the effective training of the future industrial chemist. Once those concerned with the successful administration of our industries realize the necessity for encouraging by a liberal payment the work of the efficiently trained chemist there will be no lack in the supply of suitable men. That the nation contains such men has been shown by the fact that the demands of this devastating war for the supply of high explosives have been met with an energy and an efficiency which have surprised our chief enemy.—*Nature*.

SCIENTIFIC BOOKS

The Theory of Measurements. By LUCIUS TUTTLE, B.A., M.D., Philadelphia, Dr. Lucius Tuttle, Jefferson Medical College. 1916. Pp. xiv + 303. Price \$1.25.

Any one who has read the reports on elemen-

tary laboratory work in physics presented by average students must have been impressed frequently by the writer's lack of familiarity with ordinary methods of computation and by his inability to draw rational conclusions regarding the accuracy and significance of his results. Unfortunately, the instruction in these matters presented by many widely used laboratory manuals is very inadequate and frequently misleading. We all admit that the primary object of elementary laboratory work is to put the student in personal touch with the facts and principles of physical science. But every experienced teacher knows that this object is not attainable without more or less formal instruction in the methods of reduction and interpretation of observations. Moreover, the student is seriously handicapped by the long-hand arithmetical processes taught in secondary schools when greater precision and facility can be attained by the shortened methods of computation adopted by every competent physicist.

A number of books designed to fill this gap by a detailed discussion of methods of computation and the theory of errors have appeared during the past few years. Dr. Tuttle's "Theory of Measurements" belongs in this group and it meets the needs of students in elementary physics more adequately than any other text that has come to the reviewer's attention. For the most part, concrete examples are developed to illustrate general principles and the discussions are so clear and well stated that the student can hardly fail to grasp their significance. The treatment presupposes no training in mathematics beyond that usually required for admission to college. In fact capable high-school pupils should find little difficulty in following the discussions.

The most important topics treated in the first one hundred pages of the book are as follows: fundamental ideas, abridged methods of multiplication and division, units and measurements, angles and circular functions, accuracy and the correct use of significant figures, logarithms, computations involving small magnitudes, and the use of the slide rule. The reviewer would be inclined to place more

emphasis on the importance of systematic orderliness in computation and exact specification of units in writing numerical results. But on the whole the treatment is very good and guards against most of the common errors of inexperienced computers.

About seventy pages are devoted to a very illuminating discussion of the methods of graphical representation and reduction of observations, including a brief treatment of interpolation and extrapolation. The possibility of emphasizing the significance of the plotted data by a suitable choice of scales is illustrated by numerical examples and the advantages of so choosing the variables that the graph will be linear are pointed out. The uses of logarithmic and semi-logarithmic papers are also illustrated.

The remaining portion of the book deals with errors of observation and measurement, statistical methods, the determination of the best representative value from a series of discordant observations, the estimation of the precision of direct and indirect measurements, and simple applications of the method of least squares. The formulæ of the theory of errors are not derived mathematically but their significance and use are very clearly explained and illustrated by numerical examples.

The book is neatly printed and substantially bound. It should find a place in every physical laboratory devoted to the instruction of students.

A. DEFOREST PALMER

SPECIAL ARTICLES

LITHOLOGIC EVIDENCE OF CLIMATIC PULSATIONS

THE geologic evidences of changes of climate, as is well known, are numerous and incontrovertible, particularly as regards extremes of temperature and their accompanying variations of flora and fauna. The climatic changes which have produced the most widespread changes in life forms, as well as physiographic features, have been the ones most clearly recognized and easily studied. These changes are known to have been pulsatory or periodic, but with periods or cycles